ISSN: 2572-4053

Karimi A, et al. J Sleep Disord Manag 2026, 11:049
DOI: 10.23937/2572-4053.1510049
Volume 11 | Issue 1
Open Access

Journal of Sleep Disorders and Management

ORIGINAL ARTICLE

Validation and Psychometric Evaluation of the Persian Sleep-50 Questionnaire Among Iranian Adults

*Armin Karimi[1], Amirhossein Khazaie[1,2], Sepideh Khazaie[2], Azita Chehri[1] and Amir Jalali[2,3]**

[1]*Department of Psychology, Ker. C, Islamic Azad University, Kermanshah, Iran*

[2]*Sleep Disorders Research Center, Health policy and promotion institute, Kermanshah University of Medical Sciences, Kermanshah, Iran*

[3]*Substance Abuse Prevention Research Center, Research Institute for Health, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Corresponding author: *Alvaro Taveras, MD, Hospital Metropolitano de Santiago, Santiago de los Caballeros, Dominican Republic, Tel: 1-(829)3308998*

Abstract

Introduction: Sleep disturbances are common and have significant consequences for physical and mental health. Reliable and culturally adapted instruments are essential for assessing sleep disorders across populations. This study aimed to evaluate the psychometric properties of the Persian version of the Sleep-50 questionnaire among Iranian adults.

Methods: This methodological validation study was conducted among adults in Kermanshah, Iran. Participants included individuals with sleep disorders recruited from a sleep clinic and individuals from the general population selected through cluster sampling. The Sleep-50 questionnaire was translated using a forward–backward translation procedure and culturally adapted. Participants completed the Sleep-50 along with the General Health Questionnaire (GHQ-12), the Holland Sleep Disorders Questionnaire (HSDQ), and the Pittsburgh Sleep Quality Index (PSQI). Construct validity was evaluated using exploratory and confirmatory factor analyses, and reliability was assessed using internal consistency and test–retest methods.

Results: A total of 421 participants completed the questionnaires. Factor analysis supported the nine-factor structure of the Sleep-50 questionnaire, explaining 67.49% of the total variance. Confirmatory factor analysis demonstrated acceptable model fit ($\chi^2 = 4062.28$, df = 1439, $\chi^2/df = 2.82$, CFI = 0.94, NNFI = 0.95, RMSEA = 0.078, SRMR = 0.045). Significant positive correlations were observed between the Sleep-50 and the PSQI, HSDQ, and GHQ-12, supporting convergent validity. The overall Cronbach's alpha coefficient was 0.945, and test–retest reliability over a two-week interval was 0.748.

Conclusion: The Persian version of the Sleep-50 questionnaire demonstrates satisfactory validity and reliability for assessing sleep disorders among Iranian adults and can serve as a practical tool for both clinical screening and research applications.

Keywords

Sleep-50, Sleep disorders, Psychometric validation, Questionnaire

Abbreviation

PLMD: Syndrome/Periodic Limb Movement Disorder; RLS: Restless Legs Syndrome; CRSD: Circadian Rhythm Sleep Disorder; PSQI: The Pittsburgh Sleep Quality Index; GHQ-12: General Health Questionnaire; HSDQ: Holland Sleep Disorders Questionnaire; EDS: Excessive Daytime Sleepiness; CVR: The Content Validity Ratio; CVI: Content Validity Index; EFA: Exploratory Factor Analysis; CFA: Confirmatory Factor Analysis; RMSEA: Root Mean Square Error of Approximation; NNFI/TLI: Non-Normed Fit Index; CFI: Comparative Fit Index; GFI: Goodness-of-Fit Index; SRMR: Standardized Root Mean Square Residual

Introduction

Adequate sleep is a fundamental component of overall health and quality of life, playing a critical role in physiological restoration, growth, learning, and memory consolidation [1,2]. Conversely, insufficient or disrupted sleep can lead to cognitive and behavioral impairments, fatigue, memory problems, reduced concentration, and increased psychological distress [3]. Studies have shown

Citation: Karimi A, Khazaie A, Khazaie S, et al. (2026) Validation and Psychometric Evaluation of the Persian Sleep-50 Questionnaire Among Iranian Adults. J Sleep Disord Manag 10:049. doi.org/10.23937/2572-4053.1510049

Accepted: July 07, 2026 : **Published:** July 10, 2026

that poor sleep quality is associated with functional impairment [4], increased risk of cardiovascular disease, poorer overall health, and higher mortality rates [5,6].

Approximately 30% to 45% of adults in various populations report symptoms and signs related to sleep disorders [7], which can significantly impact their psychological and physical well-being [8,9]. Sleep disorders, which represent a more severe form of sleep disturbances, are characterized by persistent disruptions in sleep quality, timing, and duration [10]. Questionnaire-based studies indicate that sleep disorders are highly prevalent worldwide [11], and substantially affect the quality of life of millions of individuals [12]. It is estimated that about one-third of individuals experience some form of sleep disorder during their lifetime [13]. The prevalence of insomnia has been reported to reach up to 40% in Canada [14], while approximately 50 to 70 million Americans suffer from a sleep disorder [15]. A multinational study reported the highest prevalence of sleep problems in the United States (56%), compared with rates ranging from 23% to 36% across European countries and approximately 23% in Japan [16].

Sleep disturbances may represent some of the earliest behavioral and physiological manifestations of underlying medical or psychiatric disorders [17]. An imbalance in the sleep-wake cycle can lead to severe fatigue and irritability, while important cellular restoration processes occur during the deepest stages of sleep [18]. Therefore, early diagnosis and treatment of sleep disorders are essential to prevent their long-term consequences [19]. Today, standardized questionnaires are commonly used for screening sleep disorders [20,21], and various assessment tools exist for this purpose [21,22]. The Sleep-50 questionnaire is a validated instrument that evaluates sleep disorders across nine subscales [23]. It has been psychometrically tested in multiple countries and has demonstrated strong validity and reliability [23-26]. Due to its comprehensive structure, the Sleep-50 questionnaire provides a useful tool for screening and evaluating multiple types of sleep disorders. Therefore, its use in Iran necessitates psychometric evaluation to ensure its applicability in the Iranian population. The present study aimed to evaluate the psychometric properties of the Sleep-50 questionnaire among Iranian adults.

Methods

Study design

This methodological validation study aimed to evaluate the psychometric properties of the Sleep-50 questionnaire in an Iranian population. The study was conducted between October 2023 and November 2024. The study protocol was approved by the Ethics Committee of Kermanshah University of Medical Sciences (IR.IAH.KSH.REC.1402.006). All participants provided informed consent prior to participation, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Setting

The study was conducted in Kermanshah, Iran, at the Sleep Disorders Research Center (SDRC) of Farabi Hospital, a referral center for sleep disorder patients in western Iran.

Participants

The study population consisted of adults aged 18 years and older residing in Kermanshah, including both individuals diagnosed with sleep disorders who attended the SDRC and individuals from the general population without a diagnosed sleep disorder.

Participant selection

Participants were recruited from two groups. The clinical group consisted of individuals diagnosed with sleep disorders who were recruited through convenience sampling from the Sleep Disorders Research Center at Farabi Hospital. The non-clinical group consisted of individuals without diagnosed sleep disorders who were recruited from the general population using cluster sampling. For this purpose, the city of Kermanshah was divided into six geographical regions. Three regions were randomly selected, and within each selected region five neighborhoods were randomly chosen. Individuals from these neighborhoods were then invited to participate using convenience sampling. In total, 421 participants were included in the final analysis.

Inclusion criteria and exclusion criteria

Eligible participants were adults aged 18 years or older who were willing to participate in the study. Individuals in the clinical group had been referred to the sleep clinic with complaints related to at least one sleep disorder, whereas individuals in the non-clinical group were recruited from the general population without a diagnosed sleep disorder. Participants who did not complete the demographic form or questionnaire were excluded from the analysis.

Sample size determination

The sample size was determined based on recommendations for validation studies using structural equation modeling, which suggest a minimum ratio of five to ten participants per questionnaire item. Because the Sleep-50 questionnaire consists of 50 items, a minimum sample size of 220 participants was required. To account for potential incomplete responses and to improve the robustness of the psychometric analyses, a total of 453 questionnaires were distributed among the clinical and non-clinical populations. Of these, 32 questionnaires were excluded due to incomplete or invalid responses, resulting in a final sample of 421 participants, including 95 individuals with sleep disorders and 326 individuals without sleep disorders.

Reliability and validity testing

Face validity was evaluated using feedback from 15 adult participants. Test-retest reliability was assessed among 20 adults who were not included in the main study sample. Content validity, both qualitative and quantitative, was evaluated by a panel of 14 experts with experience in sleep medicine and questionnaire development. To examine construct validity, the dataset was divided into two subsamples. Exploratory factor analysis (EFA) was conducted on 220 participants, while confirmatory factor analysis (CFA) was performed on the full sample of 421 participants. All participants completed the questionnaire in person using a self-report format [27,28].

Content evaluation and response process

The cultural adaptation and validation of the instrument were conducted using the ten-step cross-cultural adaptation method proposed by Wild, et al. [29,30]. After obtaining permission from the original developer of the Sleep-50 questionnaire, the instrument was translated from English into Persian using the forward-backward translation method. Two independent translators initially translated the questionnaire into Persian. The two translated versions were reviewed by the research team and merged into a single reconciled Persian version. This version was then independently back-translated into English by two different translators who were blinded to the original questionnaire. The back-translated versions were compared with the original instrument, and discrepancies were resolved through discussion within the research team. The resulting version was then sent to the original developer of the questionnaire for review, and the developer's feedback was incorporated into the final Persian version.

To assess face validity and the response process, the finalized Persian questionnaire was administered to 15 adult participants who were asked to evaluate the clarity, comprehensibility, and relevance of the items. Their feedback regarding ambiguous or difficult items was reviewed and incorporated into the questionnaire. Finally, the Persian version was reviewed by a Persian language and literature expert to ensure linguistic clarity and cultural appropriateness before being used for the psychometric analyses.

Research Instruments

Sleep-50 questionnaire

The Sleep-50 questionnaire was developed by Spoormaker, et al. (2005) to assess sleep disorders based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria [23].

The instrument contains 50 items rated on a four-point Likert scale ranging from 1 (not at all) to 4 (very much) [26] The questionnaire assesses nine domains of sleep disorders, including sleep apnea (items 1-8), insomnia (items 9-16), narcolepsy (items 17-21), restless legs syndrome/periodic limb movement disorder (items 22-25), circadian rhythm sleep disorder (items 26-28), sleepwalking (items 29-31), nightmares (items 32-36), factors affecting sleep (items 37-43), and the impact of sleep complaints on daily functioning (items 44-50). The Sleep-50 has demonstrated good psychometric properties in several populations. In the original validation study, Cronbach's alpha was reported as 0.85 [23]. Subsequent studies conducted in different countries have also confirmed its reliability and validity, including a study in Turkey that reported a Cronbach's alpha of 0.91 [23,25,26].

Pittsburgh sleep quality index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) was developed by Buysse, et al. (1989) to assess sleep quality and sleep disturbances over the previous month [31]. The questionnaire consists of 19 items that generate seven component scores evaluating different aspects of sleep quality. Each component is scored on a four-point scale (0-3), and the total score ranges from 0 to 21, with higher scores indicating poorer sleep quality. A total score greater than 6 indicates poor sleep quality [32]. The PSQI has been validated in the Iranian population, demonstrating acceptable reliability with a Cronbach's alpha of 0.83 [33].

General health questionnaire (GHQ-12)

The General Health Questionnaire-12 (GHQ-12) was developed by Goldberg and Hiller (1979) to screen for psychological distress and potential psychiatric disorders [34]. The instrument contains 12 items assessing mental health status over the previous four weeks. Responses are scored on a four-point Likert scale ranging from 0 to 3, with higher scores indicating greater psychological distress. The GHQ-12 has been validated in Iran and has demonstrated good reliability, with a reported Cronbach's alpha of 0.87 [35].

Holland sleep disorders questionnaire (HSDQ)

The Holland Sleep Disorders Questionnaire (HSDQ) was developed by Kerkhof, et al. (2012) based on the International Classification of Sleep Disorders, Second Edition (ICSD-2) [36,37]. The questionnaire assesses six categories of sleep disorders, including insomnia, circadian rhythm sleep disorders, parasomnias, hypersomnia and excessive daytime sleepiness, restless legs syndrome/periodic limb movement disorder, and sleep-disordered breathing. The validated Persian version of the HSDQ consists of 31 items across six subscales. In the Iranian validation study, Cronbach's alpha coefficients ranged from 0.701 to 0.924 for the subscales and 0.789 for the total scale [21].

Cultural adaptation and validation

After obtaining permission from the original developer of the Sleep-50 questionnaire, the translation

and cultural adaptation process followed the ten-step method proposed by Wild, et al. (2005) [30]. The questionnaire was translated from English into Persian using a forward-backward translation procedure. Two independent translators first translated the instrument into Persian. The two translated versions were reviewed by the research team and reconciled into a single Persian version. This version was then independently back-translated into English by two different translators who were blinded to the original questionnaire. The back-translated versions were compared with the original instrument, and discrepancies were resolved through discussion among the research team to produce the final Persian version. To evaluate clarity and comprehensibility, the translated questionnaire was pretested among several participants who were asked to identify ambiguous or difficult items. No substantial modifications were required based on their feedback. The final Persian version was subsequently reviewed by a Persian language and literature expert to ensure linguistic accuracy and cultural appropriateness before being used for psychometric evaluation.

Content validity evaluation

Content validity was assessed by a panel of 14 experts consisting of psychologists, psychiatric nursing faculty members, psychiatrists, and sleep specialists. The experts evaluated the clarity, relevance, grammar, and appropriateness of each item in the Persian version of the questionnaire. Quantitative content validity was assessed using the Content Validity Ratio (CVR) and the Content Validity Index (CVI). The overall CVR was 0.824 (range: 0.67-1), and the overall CVI was 0.91 (range: 0.75-1). Based on these results, no items required modification.

Face validity assessment

Face validity was evaluated qualitatively among 20 participants, including 10 patients with sleep disorders attending the Sleep Disorders Clinic in Kermanshah and 10 individuals from the general population with different educational levels and age groups. Participants were asked to review the questionnaire and identify unclear or difficult items. Their feedback was reviewed by the research team, and the questionnaire was confirmed as clear and understandable for the target population [38,39].

Data analysis

Content validity was evaluated quantitatively using the Waltz and Bausell method [40]. Construct validity was examined using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA was conducted on a subsample of 220 participants, while CFA was performed on the full sample of 421 participants. The normality of data distribution was assessed using skewness and kurtosis indices. Pearson correlation coefficients were calculated to examine relationships among variables. All statistical analyses were performed using SPSS version 27 and LISREL version 8.

Reliability assessment

Reliability was evaluated by examining both internal consistency and temporal stability. Internal consistency was assessed using Cronbach's alpha coefficient and McDonald's omega. Test–retest reliability was evaluated by administering the Sleep-50 questionnaire to 20 participants twice with a two-week interval between administrations.

Results

A total of 421 participants completed the GHQ-12, HSDQ, PSQI, and Sleep-50 questionnaires. Examination of the distribution of item responses showed skewness values ranging from-1.82 to 1.86 and kurtosis values from -1.55 to 1.62, indicating that the data were approximately normally distributed.

Descriptive results

EFA was conducted on a subsample of 220 participants. The mean age of this group was 38.35 ± 11.99 years, and the mean body mass index (BMI) was 26.46 ± 4.83. CFA was subsequently performed on the full sample of 421 participants, including both patients with sleep disorders and individuals from the general population. In this cohort, the mean age was 35.32 ± 11.37 years and the mean BMI was 25.56 ± 4.99 (Table 1).

Construct validation results

Exploratory factor analysis (EFA): EFA was performed on the responses of 220 participants to examine the construct validity of the Persian version of the Sleep-50 questionnaire. The KMO measure of sampling adequacy was 0.875, indicating that the sample was suitable for factor analysis. Bartlett's test of sphericity was statistically significant ($\chi^2 = 9615.67$, $p < 0.001$), confirming sufficient correlations among the items.

Factor extraction was performed using the maximum likelihood method with direct oblimin rotation. Factors with eigenvalues greater than 1 were retained. The communalities and factor loadings of the extracted items are presented in (Table 2).

Factor structure and variance explained: The analysis identified a nine-factor structure corresponding to the theoretical domains of the Sleep-50 questionnaire. These factors collectively explained 67.496% of the total variance across the 50 items. The eigenvalues of the extracted factors, their individual variance contributions, and cumulative variance explained are summarized in Table 2. The scree plot derived from the factor analysis is presented in (Figure 1).

Confirmatory factor analysis (CFA)

CFA was performed on the full sample of 421 participants to evaluate the fit of the hypothesized

Table 1: Demographic characteristics of participants in the study.

Variable	(EFA) (n = 220)		(CFA) (n = 421)	
	N	(%)	N	(%)
Gender				
Female	120	54.5	268	63.7
Male	100	45.5	153	36.3
Marital Status				
Single	71	32.3	181	43.0
Married	134	60.9	213	50.6
Widowed/Divorced	15	6.8	27	6.4
Educational Level				
Primary School	16	7.3	22	5.2
Middle School	14	6.4	19	4.5
High School	46	20.9	80	19.0
Bachelor's Degree	101	45.9	189	44.9
Postgraduate Degree	43	19.6	111	26.4
Place of Residence				
Urban	219	99.5	417	99.1
Rural	1	0.5	4	0.9
Housing Type				
Villa	94	42.7	175	41.6
Apartment	118	53.6	232	55.1
Residential Complex	8	3.6	14	3.3
Employment Status				
Employee	61	27.7	109	25.9
Self-employed	72	32.7	137	32.6
Laborer	8	3.6	12	2.9
Driver	3	1.4	4	1.0
Retired	12	5.5	16	3.8
Unemployed	41	18.6	81	19.2
Housewife	23	10.5	62	14.7
Shift Work Status				
Day Shift	194	88.2	359	85.3
Rotational Shift	26	11.8	62	14.7

nine-factor structure of the Sleep-50 questionnaire. The distribution of responses showed skewness and kurtosis values within the acceptable range (-2 to 2), indicating approximate normality of the data. Factor loadings for all items were statistically significant, with t-values exceeding 3.29 ($p < 0.001$). Model fit indices indicated an acceptable fit for the proposed model: $\chi^2 = 4062.28$, df = 1439, $\chi^2/df = 2.82$, RMSEA = 0.078, NNFI = 0.95, CFI = 0.94, GFI = 0.94, and SRMR = 0.045. These results support the adequacy of the nine-factor structure of the Sleep-50 questionnaire. The standardized factor loadings obtained from the CFA model are presented in Table 3, and the standardized path diagram is illustrated in (Figure 2).

Internal consistency of the instrument

Internal consistency of the Persian version of the Sleep-50 questionnaire was evaluated using Cronbach's alpha coefficients. The overall Cronbach's alpha for the scale was 0.945, indicating excellent internal consistency. Test–retest reliability was also assessed, yielding a coefficient of 0.748, suggesting acceptable temporal stability. Cronbach's alpha coefficients for the nine subscales ranged from 0.735 to 0.912 (Table 4).

Inter-factor correlations

Pearson correlation coefficients were calculated to examine relationships among the Sleep-50 subscales and the overall scale. All subscales showed significant positive correlations with the total Sleep-50 score ($p < 0.01$). Significant correlations were also observed among the subscales, indicating coherent relationships between the different dimensions of sleep disorders measured by the instrument (Table 4).

Convergent validity results

Convergent validity was examined by assessing correlations between Sleep-50 scores and scores from the PSQI, HSDQ, and GHQ-12. Significant positive correlations were observed between Sleep-50 and PSQI ($r = 0.61$, $p < 0.001$), HSDQ ($r = 0.63$, $p < 0.01$), and GHQ-12 ($r = 0.39$, $p < 0.01$). These findings indicate that higher Sleep-50 scores were associated with poorer sleep quality and greater psychological distress, supporting the convergent validity of the Persian version of the Sleep-50 questionnaire (Table 4).

Discussion

This study evaluated the psychometric properties of the Persian version of the Sleep-50 questionnaire among Iranian adults. Overall, the findings indicate that the translated instrument demonstrates satisfactory validity and reliability and retains the multidimensional structure of the original questionnaire developed by Spoormaker, et al. [23]. The results support the applicability of the Sleep-50 as a comprehensive self-report measure for assessing a wide range of sleep-related complaints in the Iranian population.

The exploratory factor analysis identified nine factors corresponding to the original conceptual structure of the Sleep-50 questionnaire, collectively explaining 67.49% of the total variance. Confirmatory factor analysis further supported this structure, with acceptable model fit indices (CFI = 0.94, NNFI = 0.95, RMSEA = 0.078, SRMR = 0.045). These findings are consistent with previous validations of the Sleep-50 in other populations. For example, the Turkish validation study conducted by Yildirim, et al. also supported the multidimensional structure of the questionnaire and reported strong construct validity among university students [26]. Similarly, confirmatory factor analysis in a U.S. sample demonstrated acceptable model fit indices, supporting the cross-cultural stability of the Sleep-50 factorial structure [25]. The consistency of these findings suggests that the Sleep-50 maintains a stable structural framework across different cultural settings.

Reliability analyses demonstrated high internal consistency for the Persian version of the questionnaire. The overall Cronbach's alpha coefficient of 0.945 indicates excellent internal consistency and is comparable to reliability estimates reported in previous

Table 2: Item factor loadings from exploratory factor analysis in the Sleep-50 (N = 220).

	Factor									Communality
	1	2	3	4	5	6	7	8	9	
S1	0.147	0.109	0.068	0.076	0.550	-0.096	-0.187	0.069	0.034	0.469
S2	0.302	0.340	0.256	0.149	0.586	-0.316	-0.453	-0.013	0.380	0.618
S3	0.168	0.191	0.097	0.114	0.930	-0.227	-0.314	0.004	0.236	0.848
S4	0.042	0.318	0.144	0.131	0.611	-0.338	-0.297	0.135	0.245	0.618
S5	0.203	0.238	0.253	0.211	0.646	-0.212	-0.428	0.035	0.241	0.606
S6	0.078	0.185	0.106	0.142	0.842	-0.288	-0.256	0.103	0.245	0.784
S7	0.180	0.215	0.096	0.186	0.849	-0.253	-0.323	-0.107	0.350	0.828
S8	0.135	0.185	0.167	0.138	0.838	-0.232	-0.395	-0.087	0.194	0.820
S9	0.300	0.019	0.941	0.145	0.193	-0.179	-0.375	0.106	0.125	0.911
S10	0.229	.066	0.915	0.217	0.179	-0.181	-0.427	-0.029	0.188	0.880
S11	0.283	0.095	0.811	0.161	0.164	-0.119	-0.394	-0.064	0.200	0.763
S12	0.261	0.096	0.883	0.205	0.117	-0.166	-0.303	-0.024	0.131	0.810
S13	0.257	0.011	0.746	0.135	0.063	-0.070	-0.256	-0.058	0.058	0.664
S14	0.228	0.024	0.785	0.051	0.087	-0.112	-0.268	0.114	0.134	0.717
S15	0.196	-0.026	0.747	0.174	0.076	-0.074	-0.263	-0.108	0.072	0.712
S16	.255	.034	0.808	0.169	0.113	-0.056	-0.293	0.124	0.116	0.825
S17	0.234	0.186	0.169	0.267	0.179	-0.737	-0.343	-0.140	0.106	0.746
S18	0.291	0.272	0.093	0.242	0.260	-0.847	-0.311	0.036	0.361	0.785
S19	0.320	0.215	0.116	0.227	0.233	-0.882	-0.360	0.069	0.268	0.831
S20	0.196	0.192	0.183	0.186	0.244	-0.863	-0.466	-0.153	0.311	0.803
S21	0.252	0.275	0.111	0.223	0.287	-0.907	-0.340	-0.037	0.369	0.840
S22	0.290	0.196	0.086	0.232	0.195	-0.271	-0.288	0.063	0.624	0.552
S23	0.245	0.232	0.304	0.157	0.297	-0.265	-0.413	-0.101	0.539	0.487
S24	0.373	0.323	0.158	0.252	0.346	-0.332	-0.431	-0.096	0.821	0.737
S25	0.344	0.264	0.195	0.275	.230	-0.268	-0.282	-0.096	0.675	0.600
S26	0.638	0.213	0.293	0.162	0.167	-0.421	-0.398	-0.090	0.395	0.613
S27	0.980	0.229	0.393	0.184	0.268	-0.371	-0.419	-0.031	0.339	0.799
S28	0.718	0.252	0.291	0.063	0.227	-0.261	-0.276	0.123	0.360	0.685
S29	0.199	0.268	0.178	0.321	0.191	-0.284	-0.551	0.017	0.351	0.611
S30	0.276	0.401	0.045	0.173	0.114	-0.305	-0.458	-0.045	0.358	0.529
S31	0.301	0.446	0.194	0.325	0.277	-0.454	-0.603	-0.184	0.303	0.681
S32	0.126	0.134	0.162	.863	0.222	-0.270	-0.301	0.074	0.403	0.805
S33	0.021	0.160	0.153	0.883	0.117	-0.293	-0.238	0.010	0.271	0.807
S34	0.030	0.049	0.151	0.870	0.160	-0.178	-0.233	-0.097	0.149	0.796
S35	0.131	0.035	0.188	0.830	0.080	-0.169	-0.225	-0.095	0.093	0.776
S36	0.233	0.181	0.195	0.737	0.188	-0.300	-0.306	-0.075	0.428	0.676
S37	0.187	0.926	0.051	0.098	0.233	-0.266	-0.158	-0.131	0.289	0.882
S38	0.200	0.940	0.049	0.131	0.266	-0.287	-0.112	-0.126	0.324	0.906
S39	0.177	0.882	.0043	0.088	0.190	-0.188	-0.065	0.000	0.225	0.829
S40	0.169	0.848	-0.004	0.064	0.174	-0.199	-0.111	-0.124	0.289	0.794
S41	0.192	0.890	0.051	0.096	0.245	-0.279	-0.175	-0.214	0.387	0.839
S42	0.061	0.766	0.093	0.177	0.191	-0.268	-0.299	-0.616	0.319	0.879
S43	0.109	0.783	0.094	0.169	0.210	-0.324	-0.326	-0.677	0.335	0.899
S44	0.275	0.222	0.312	0.321	0.507	-0.413	-0.860	-0.130	0.236	0.790
S45	0.304	0.138	0.249	0.265	0.416	-0.380	-0.816	-0.105	0.282	0.736
S46	0.401	0.184	0.321	0.264	0.328	-0.429	-0.831	-0.148	0.345	0.791
S47	0.158	0.099	0.259	0.195	0.206	-0.286	-0.568	-0.097	0.186	0.474
S48	0.291	0.231	0.317	0.294	0.317	-0.423	-0.766	-0.245	0.401	0.727
S49	0.319	0.176	0.494	0.255	0.248	-0.342	-0.690	0.050	0.313	0.690
S50	0.370	0.131	0.496	0.362	0.276	-0.325	-0.697	0.029	0.281	0.683
Eigenvalues	**6.884**	**7.346**	**6.001**	**4.035**	**3.152**	**2.391**	**1.495**	**1.158**	**1.287**	
% of Variance	**13.767**	**14.693**	**12.002**	**8.069**	**6.303**	**4.782**	**2.989**	**2.316**	**2.575**	

KMO = 0.875; Bartlett's test of sphericity: $\chi 2 = 9615.67$, df = 1225, $p < 0.001$

Table 3: T-value, Pearson correlation coefficient, factor loadings, ICC and Cronbach Alpha of the Sleep-50 (N = 421).

Factor	No	t_{value} [a]	(λ)[b]	Rc	Cronbach Alpha
Factor 5	Q1	12.1	0.56***	0.388**	0.878
	Q2	13.77	0.63***	0.607**	
Sleep apnea	Q3	21.79	0.87***	0.531**	
	Q4	14.17	0.64***	0.497**	
	Q5	15.69	0.69***	0.570**	
	Q6	20.57	0.84***	0.495**	
	Q7	15.11	0.67***	0.498**	
	Q8	15.5	0.69***	0.569**	
Factor 3	Q9	21.72	0.86***	0.569**	0.893
	Q10	21.87	0.87***	0.618**	
Insomnia	Q11	18.39	0.77***	0.599**	
	Q12	18.51	0.78***	0.587**	
	Q13	10.42	0.49***	0.321**	
	Q14	13.24	0.60***	0.376**	
	Q15	12.44	0.57***	0.360**	
	Q16	16.73	0.72***	0.468**	
Factor 6	Q17	11.46	0.55***	0.444**	0.834
	Q18	16.57	0.73***	0.509**	
Narcolepsy	Q19	17.51	0.76***	0.549**	
	Q20	16.82	0.74***	0.585**	
	Q21	18.55	0.79***	0.572**	
Factor 9	Q22	12.09	0.58***	0.419**	0.784
	Q23	14.92	0.68***	0.584**	
RLS/PLMD	Q24	19.84	0.84***	0.613**	
	Q25	15.35	0.70***	0.536**	
Factor1	Q26	17.68	0.78***	0.560**	0.767
	Q27	20.11	0.86***	0.627**	
CRSD	Q28	11.22	0.54***	0.393**	
Factor 8	Q29	15.81	0.72***	0.472**	0.735
Sleep walking	Q30	14.48	0.68***	0.376**	
	Q31	17.48	0.78***	0.598**	
Factor 4	Q32	22.87	0.89***	0.544**	0.912
Nightmares	Q33	21.49	0.86***	0.485**	
	Q34	2.69	0.84***	0.432**	
	Q35	17.86	0.76***	0.375**	
	Q36	18.98	0.79***	0.576**	
Factor 2	Q37	18.15	0.77***	0.435**	0.878
Factors influencing sleep	Q38	21.12	0.85***	.501**	
	Q39	18.79	0.79***	0.362**	
	Q40	16.33	0.71***	0.366**	
	Q41	18.94	0.79***	0.487**	
	Q42	12.69	0.59***	0.552**	
	Q43	13.29	0.61***	0.586**	
Factor 7	Q44	20.77	0.84***	0.700**	0.895
Impact of sleep complaints on daily functioning	Q45	19.4	0.80***	0.641**	
	Q46	20.73	0.84***	0.691**	
	Q47	11.68	0.54***	0.474**	
	Q48	18.36	0.77***	0.677**	
	Q49	15.69	0.69***	0.651**	
	Q50	16.87	0.73***	0.681**	
Factor	**No**	**t_{value} [a]**	**(λ)[b]**	**Rc**	**Cronbach Alpha 0.945**

***P < 0.001; **P < 0.01; *P < 0.05

A) The calculated values for all factor loadings of the first and second orders are greater than 1.96 and are therefore significant at the 95% confidence level; B) The specific value, which is denoted by the Lamda coefficient and the statistical symbol λ, is calculated from the sum of the factors of the factor loads related to all the variables of that factor; C) Pearson Correlation coefficient

Table 4: The sleep-50 (N = 421).

	ISCDF	Nightmares	FIS	Sleep Walking	CRSD	RLS/PLMD	Narcolepsy	Insomnia	Sleep apnea	Sleep-50
ISCDF	1									
Nightmares	0.38**	1								
FIS	0.38**	0.27**	1							
Sleep Walking	0.31**	0.37**	0.48**	1						
CRSD	0.50**	0.21**	0.34**	0.43**	1					
RLS/PLMD	0.41**	0.25**	0.34**	0.30**	0.37**	1				
Narcolepsy	0.53**	0.32**	0.39**	0.45**	0.46**	0.39**	1			
Insomnia	0.51**	0.29**	0.32**	0.27**	0.42**	0.55**	0.37**			
Sleep apnea	0.42**	0.24**	0.37**	0.34**	0.33**	0.28**	0.43**	0.25**	1	
Sleep-50	0.82**	0.55**	0.62**	0.59**	0.64**	0.49**	0.68**	0.55**	0.69**	1

**P < 0.01

Note: Correlations are latent factor correlation estimates from the CFA model.

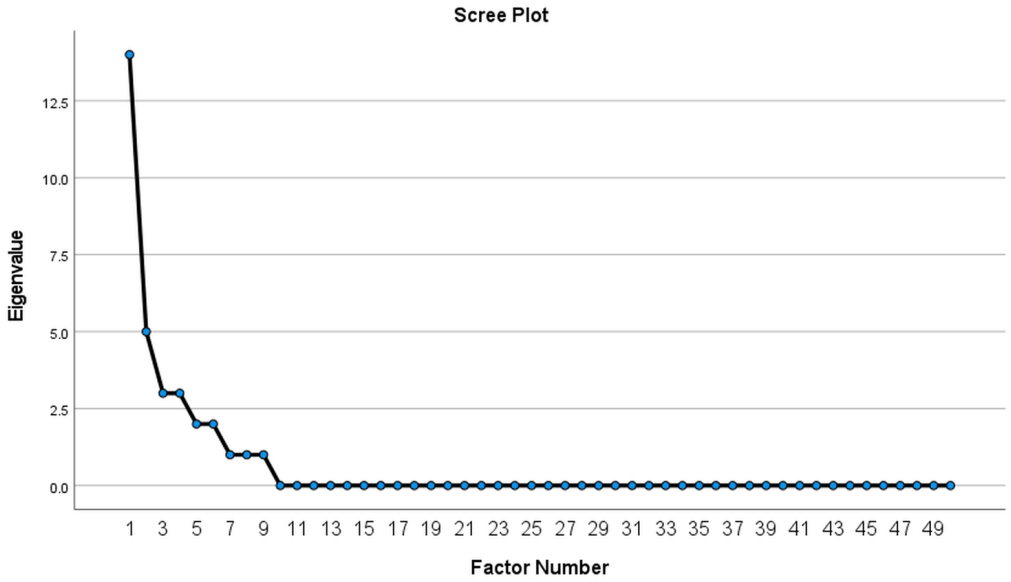

Figure 1: Scree cattle of the extracted components of the Sleep-50 (N = 220).

studies of the Sleep-50 [23,25,26]. Subscale reliability coefficients ranged from 0.735 to 0.912, suggesting acceptable reliability across the different domains of sleep disorders measured by the instrument. The slightly lower reliability observed in the sleepwalking subscale may reflect the relatively low prevalence of parasomnia symptoms or variability in self-reported experiences.

Test-retest reliability analysis also indicated acceptable temporal stability, with a reliability coefficient of 0.748 over a two-week interval. Although slightly lower than the internal consistency estimates, this value still indicates adequate stability over time. Sleep patterns may fluctuate due to environmental, behavioral, and psychological factors, which could partially explain moderate variations in repeated measurements.

Evidence for convergent validity was also observed. The Sleep-50 showed significant positive correlations with the Pittsburgh Sleep Quality Index, the Holland Sleep Disorders Questionnaire, and the General Health Questionnaire. These results are consistent with theoretical expectations that sleep disturbances are associated with poorer sleep quality and reduced general health [31,36,37]. Previous research has also demonstrated strong associations between sleep disorders, psychological distress, and functional impairment [5,41]. The moderate correlation observed with the GHQ-12 further highlights the well-established relationship between sleep disturbances and mental health outcomes [42,43].

The cultural adaptation process also played an important role in ensuring the suitability of the instrument for the Iranian population. Following established translation and cross-cultural adaptation procedures helped ensure linguistic clarity and cultural relevance [29,30]. Expert review and participant feedback indicated that the translated items were understandable and appropriate for the target

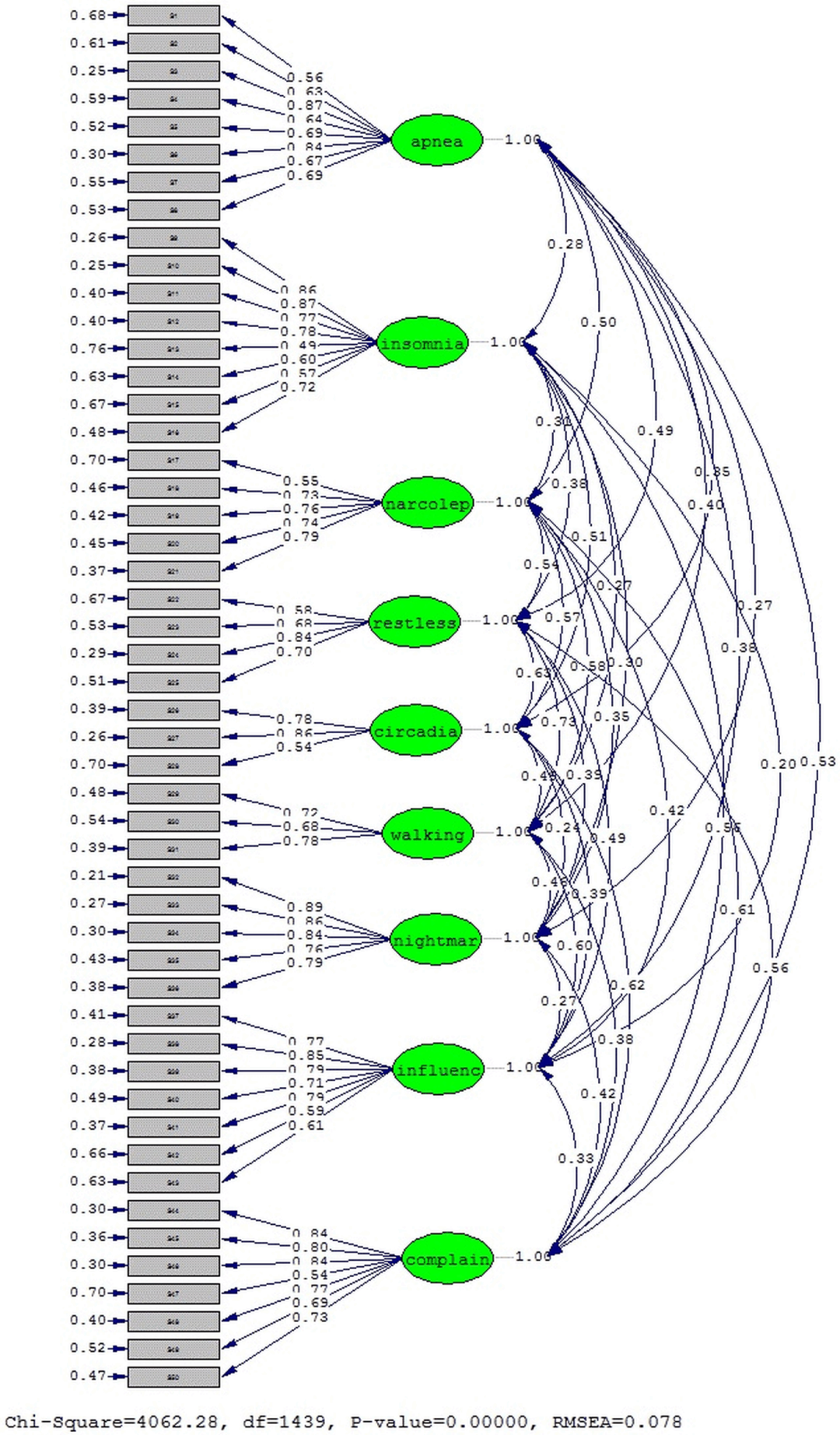

Figure 2: Final measurement model of the Sleep-50 from confirmatory factor analysis (N = 421).

population, supporting the content validity of the Persian version.

Several limitations should be considered when interpreting these findings. First, participants were recruited from a single city in western Iran, which may limit the generalizability of the results to the broader Iranian population. Future studies should include participants from different regions and demographic backgrounds to improve representativeness. Second, the study relied on self-reported data, which may introduce recall bias or reporting bias. Objective sleep assessments such as polysomnography were not included and therefore could not be used to confirm self-reported sleep symptoms. This limitation is common in questionnaire-based sleep research [23,25,26]. Third, although test-retest reliability demonstrated acceptable stability, longer follow-up intervals may provide additional insight into the temporal stability of sleep disorder symptoms.

Despite these limitations, the present study provides important evidence supporting the reliability and validity of the Persian version of the Sleep-50 questionnaire. The instrument offers a practical and comprehensive tool for screening a wide range of sleep disorders in both clinical and research settings. Given the increasing recognition of sleep disorders as a major public health concern, validated assessment tools are essential for identifying sleep problems and facilitating appropriate interventions [12]. Future research should evaluate the performance of the Persian Sleep-50 in larger and more diverse populations across Iran. Incorporating objective sleep measurements, such as polysomnography or actigraphy, could further strengthen evidence for the instrument's diagnostic accuracy. Longitudinal studies may also help determine the questionnaire's usefulness in monitoring treatment outcomes and changes in sleep patterns over time.

Conclusion

The Persian version of the Sleep-50 questionnaire demonstrates satisfactory psychometric properties, including strong internal consistency, acceptable temporal stability, and good construct and convergent validity. These findings suggest that the instrument is a reliable and valid tool for assessing sleep disorders among Iranian adults and may be useful for both clinical screening and research applications.

Availability of Data and Materials

The original contributions presented in the study are included in the article further inquiries can be directed to the corresponding author.

Competing Interests

All authors declare no competing interests.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Authors' Contributions

All authors were involved in the conceptualization of the project and reviewed and edited the manuscript. AJ, AK & AC led the study and was responsible for data curation, formal analysis, methodology, data visualization, and drafting the original manuscript. All authors have reviewed and approved the final manuscript.

Acknowledgements

We would also like to express our gratitude to all the participants, as well as other individuals and organizations, for their contributions to this study.

References

1. Ramar K, Malhotra RK, Carden KA, Martin JL, Abbasi-Feinberg F, et al. (2021) Sleep is essential to health: An American academy of sleep medicine position statement. J Clin Sleep Med 17: 2115-2119.
2. Bemanalizadeh M, Parsapoor M, Emami L, Imani V, Parsapour Z, et al. (2024) The association between sleep consolidation and growth and development in early childhood: A systematic review. Health Promot Perspect 14: 312-318.
3. Kamphuis J, Meerlo P, Koolhaas JM, Lancel M (2012) Poor sleep as a potential causal factor in aggression and violence. Sleep Med 13: 327-334.
4. Sonmez I, Karasel S (2019) Poor sleep quality I related to impaired functional status following stroke. J Stroke Cerebrovasc Dis 28:104349.
5. Huang B-H, Del Pozo Cruz B, Teixeira-Pinto A, Cistulli PA, Stamatakis E (2023) Influence of poor sleep on cardiovascular disease-free life expectancy: A multi-resource-based population cohort study. BMC Med 21: 75.
6. Kadier K, Qin L, Ainiwaer A, Rehemuding R, Dilixiati D, et al. (2022) Association of sleep-related disorders with cardiovascular disease among adults in the United States: A cross-sectional study based on national health and nutrition examination survey 2005-2008. Front Cardiovasc Med 9: 954238.
7. Gordon NP, Yao JH, Brickner LA, Lo JC (2022) Prevalence of sleep-related problems and risks in a community-dwelling older adult population: A cross-sectional survey-based study. BMC Public Health 22: 2045.
8. Salehi Z, Pasha H, Hosseini SR, Kheirkhah F, Bijani A (2023) The impact of social support, physical and psychological performance on sleep outcomes in Iranian older adults: A case-control study. BMC geriatrics 23: 791.
9. Wickham SR, Amarasekara NA, Bartonicek A, Conner TS (2020) The big three health behaviors and mental health and well-being among young adults: A cross-sectional investigation of sleep, exercise, and diet. Front Psychol 11: 579205.
10. Bollu PC, Kaur H (2019) Sleep medicine: Insomnia and sleep. Mo Med 116: 68-75.

11. Benbir G, Demir AU, Aksu M, Ardic S, Firat H, et al. (2015) Prevalence of insomnia and its clinical correlates in a general population in Turkey. Psychiatry Clin Neurosci 69: 543-552.
12. Salari N, Khazaie H, Hosseinian-Far A, Ghasemi H, Mohammadi M, et al. (2020) The prevalence of sleep disturbances among physicians and nurses facing the COVID-19 patients: A systematic review and meta-analysis. Global Health 16: 92.
13. Visvalingam N, Sathish T, Soljak M, Chua AP, Dunleavy G, et al. (2020) Prevalence of and factors associated with poor sleep quality and short sleep in a working population in Singapore. Sleep Health 6: 277-287.
14. Morin CM, LeBlanc M, Bélanger L, Ivers H, Mérette C, et al. (2011) Prevalence of insomnia and its treatment in Canada. Can J Psychiatry 56: 540-548.
15. Institute of Medicine Committee on Sleep M, Research (2006) The national academies collection: Reports funded by national institutes of health. In: Colten HR, Altevogt BM, Sleep disorders and sleep deprivation: An unmet public health problem. Washington (DC): National Academies Press (US) Copyright© 2006, National Academy of Sciences.
16. Léger D, Poursain B, Neubauer D, Uchiyama M (2008) An international survey of sleeping problems in the general population. Curr Med Res Opin 24: 307-317.
17. Yong LC, Li J, Calvert GM (2017) Sleep-related problems in the US working population: Prevalence and association with shiftwork status. Occup Environ Med 74: 93-104.
18. Shamsaei F, Cheraghi F (2010) Study of comorbidity of sleep disorders and general health in people of Hamadan. Scientific Journal of Hamadan School of Nursing and Midwifery 20: 40-45.
19. Cheng MCF, Steier J (2022) Pre-operative screening for sleep disordered breathing: Obstructive sleep apnoea and beyond. Breathe (Sheff) 18: 220072.
20. Chehri A, Goldaste N, Ahmadi S, Khazaie H, Jalali A (2021) Psychometric properties of insomnia severity index in Iranian adolescents. Sleep science (Sao Paulo, Brazil) 14: 101-106.
21. Khazaie H, Jalali A, Mohammadi R, Chehri A, Khazaie A. (2022) Assessment of the psychometric properties of the holland sleep disorders questionnaire in the Iranian population. Sleep Disord 2022: 1367067.
22. Soldatos CR, Dikeos DG, Paparrigopoulos TJ (2000) Athens insomnia scale: Validation of an instrument based on ICD-10 criteria. J Psychosom Res 48: 555-560.
23. Spoormaker VI, Verbeek I, Van den Bout J, Klip EC (2005) Initial validation of the SLEEP-50 questionnaire. Behav Sleep Med 3: 227-246.
24. Buysse DJ, Yu L, Moul DE, Germain A, Stover A, et al. (2010) Development and validation of patient-reported outcome measures for sleep disturbance and sleep-related impairments. Sleep 33: 781-792.
25. Ricketts EJ, Rozenman M, Snorrason Í, Pérez JB, Peng MG, et al. (2019) Confirmatory factor analysis of the SLEEP-50 Questionnaire in Trichotillomania (Hair-Pulling Disorder) and Excoriation (Skin-Picking) Disorder. Psychiatry Res 273: 197-205.
26. Yıldırım A, Öğülmüş S, Yılmaz O, Boysan M (2018) A psychometric investigation into the Turkish version of the SLEEP-50 Questionnaire. J Cogn Behav Psychother Res 7: 127-132.
27. Kyriazos TA (2018) Applied psychometrics: Sample size and sample power considerations in factor analysis (EFA, CFA) and SEM in general. Psychology 9: 2207.
28. White M (2022) Sample size in quantitative instrument validation studies: A systematic review of articles published in Scopus, 2021. Heliyon 8: e12223.
29. Wild D, Grove A, Martin M, Eremenco S, McElroy S, et al. (2005) Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: Report of the ISPOR task force for translation and cultural adaptation. Value Health 8: 94-104.
30. De Winter JC, Dodou D, Wieringa PA (2009) Exploratory factor analysis with small sample sizes. Multivariate Behav Res 44: 147-181.
31. Buysse DJ, Reynolds CF, 3rd, Monk TH, Berman SR, Kupfer DJ (1989) The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. Psychiatry Res 28: 193-213.
32. Chehri A, Nourozi M, Eskandari S, Khazaie H, Hemati N, et al. (2020) Validation of the Persian version of the Pittsburgh sleep quality index in elderly population. Sleep Sci 13: 119-24.
33. Ahmadi S, Khankeh H, Mohammadi F, Khoshknab F, Reza Soltani P (2010) The effect of sleep restriction treatment on quality of sleep in the elders. Iran J Ageing 5.
34. Goldberg DP, Hillier VF (1979) A scaled version of the general health questionnaire. Psychol Med 9: 139-145.
35. Montazeri A, Harirchi AM, Shariati M, Garmaroudi G, Ebadi M, et al. (2003) The 12-item general health questionnaire (GHQ-12): Translation and validation study of the Iranian version. Health Qual Life Outcomes 1: 66.
36. Kerkhof GA (2017) Epidemiology of sleep and sleep disorders in The Netherlands. Sleep Med 30: 229-239.
37. Kerkhof GA, Geuke ME, Brouwer A, Rijsman RM, Schimsheimer RJ, et al. (2013) Holland sleep disorders questionnaire: A new sleep disorders questionnaire based on the international classification of sleep disorders-2. J Sleep Res 22: 104-107.
38. Schultz KS, DJ W, Michael Zickar J (2005) Measurement theory in action: Case studies and exercises. (1st edn), Thousand Oaks, CA: Sage.
39. Perneger TV, Courvoisier DS, Hudelson PM, Gayet-Ageron A (2015) Sample size for pre-tests of questionnaires. Qual Life Res 24: 147-151.
40. Polit DF, Beck CT, Owen SV (2007) Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. Res Nurs Health 30: 459-467.
41. Medic G, Wille M, Hemels ME (2017) Short- and long-term health consequences of sleep disruption. Nat Sci Sleep 9: 151-61.
42. Garbarino S, Lanteri P, Bragazzi NL, Magnavita N, Scoditti E (2021) Role of sleep deprivation in immune-related disease risk and outcomes. Commun Biol 4: 1304.
43. Gravesande J, Richardson J, Griffith L, Scott F (2019) Test-retest reliability, internal consistency, construct validity and factor structure of a falls risk perception questionnaire in older adults with type 2 diabetes mellitus: A prospective cohort study. Arch Physiother 9: 14.